



# The SmartSite® RPO Process

by  
**Richard Cronce, Ph.D.**  
April 3, 2003



SYSTEMS

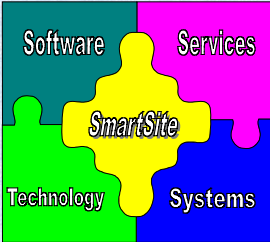
OPTIMIZATION



## SAICSmartSite®

Remedial  
Process  
Optimization  
(RPO)


+



Long  
Term  
Monitoring  
(LTM)

+

Using a Systems Engineering Approach to integrate new technologies with proven operating, maintenance and monitoring methods to reduce costs, simplify operations and accelerate to closure.



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An Employee-Owned Company

## SmartSite® Overview

- A systems approach to operations, maintenance and monitoring
- Combines SAIC's domain knowledge with systems engineering/integration skills
- Results in:
  - >20% cost savings
  - Quick (<2 yr.) payback
  - An integrated RAO/LTM program
  - Empowered operators and managers
  - Documented QA/QC


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## SAICSmartSite® Systems Engineering Approach

- Technology Enhancement
- Equipment Upgrade
- Process Automation
- Information Management
- O&M Services

- Good Engineering Practices
- Proactive Regulatory Approach
- Performance-based Metrics



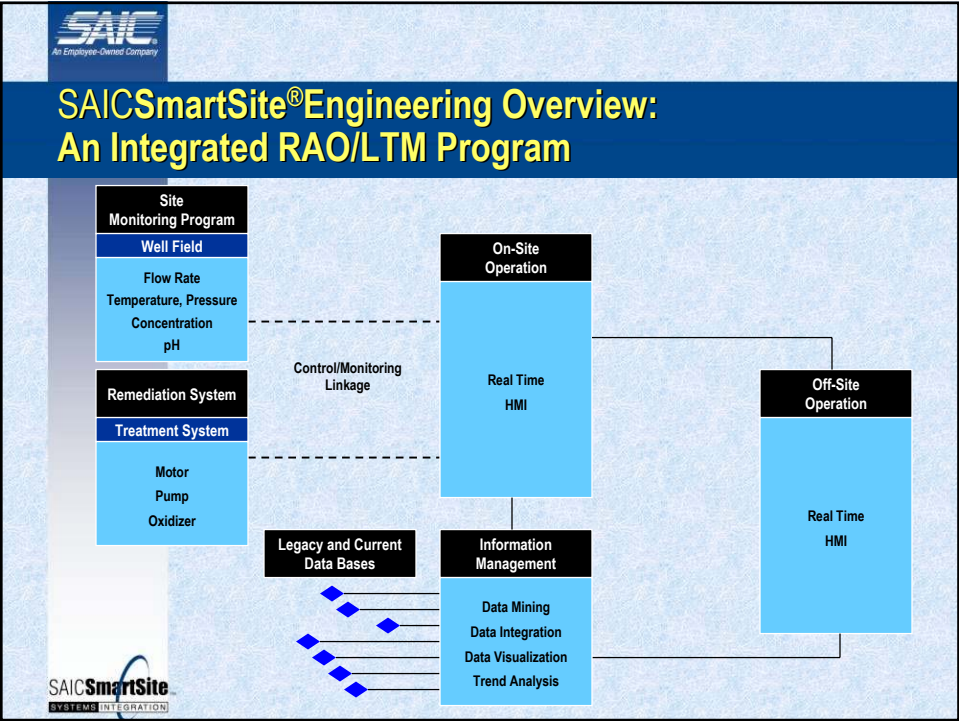
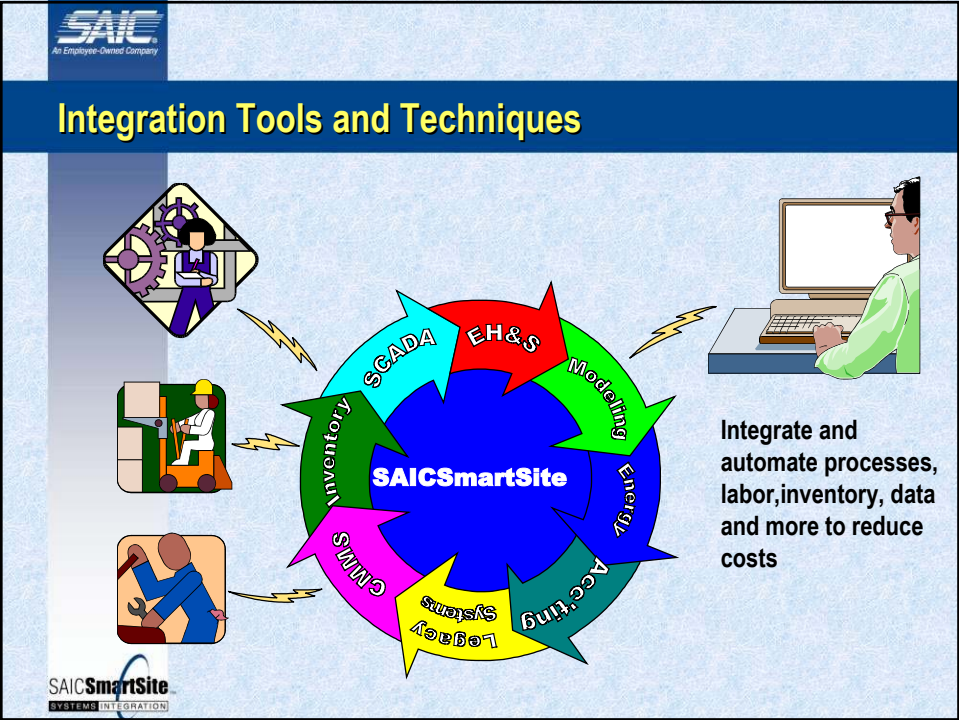
- Proactive Managers
- Innovative Engineers
- Empowered Operators

- Operating Systems
- Monitoring Programs

**Optimize Performance**  
**Minimize Costs**  
**Mitigate Risk**

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## Key SmartSite® Success Features




- Programmatic approach provides logical framework for complex analysis
- Systems engineering analysis evaluates interrelated cost and performance factors
- Integration of emerging and proven technologies yields high value at low cost
- Use of modern IT tools to integrate operations, maintenance, and monitoring data improves and simplifies management
- Fully documented, performance based results support continued improvements



## Primary Goals – Typical Results

- An integrated, more easily managed program.
- Empowered operators and managers.
- Improved communications and documentation.
- Improved systems performance and reliability.
- 20% - 40 % cost savings from labor, utilities, materials, analytical, etc.
- 2 - 3 yr. payback on optimization investments.
- Accelerated closure.





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## SmartSite® Approach

- **Program Elements Approach:**
  - ✓ Treatment approach
  - ✓ Mechanical system components
  - ✓ Operations and maintenance
  - ✓ Environmental and treatment system monitoring
  - ✓ Administrative and regulatory
- **Systems Engineering Approach to Analysis:**
  - ✓ Interdisciplinary team approach
  - ✓ Evaluates all aspects of the program
  - ✓ Analysis of interrelated problems and solutions

**Olivetti Office** - Optimization of *all elements* of this complex groundwater and soil remediation program resulted in annual cost savings of approximately \$110K, and reduced time to closure by up to 5 years.

**O-FIELD Landfill** - Systems approach to analysis of performance and costs of packed tower supported elimination of the tower and associated GAC, O&M, and monitoring, yielding annual savings of \$55K.

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## SmartSite® Approach (cont.)

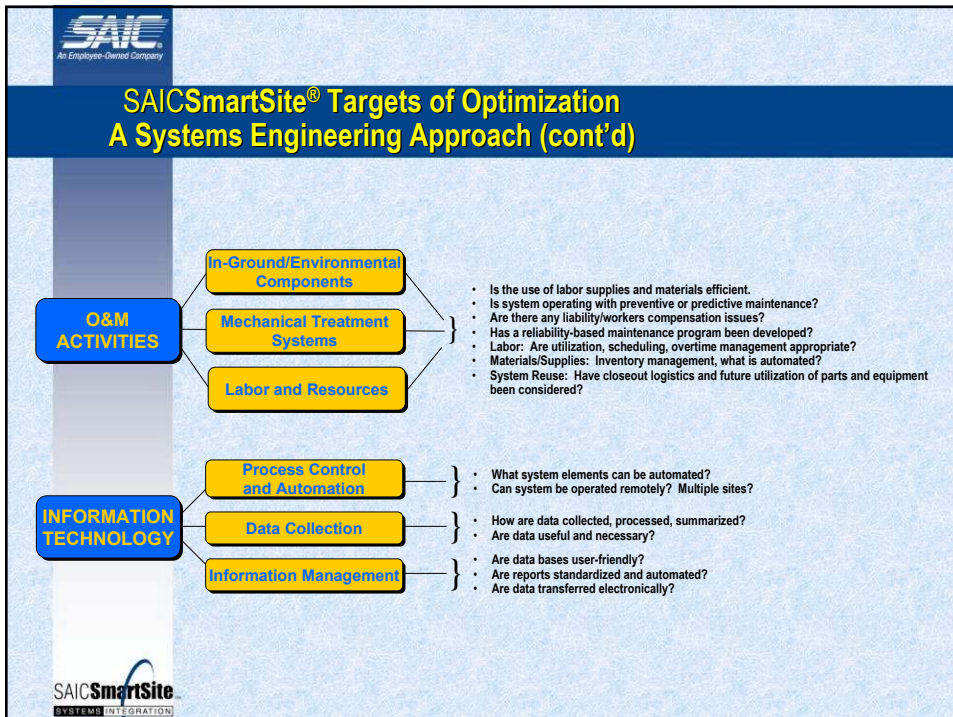
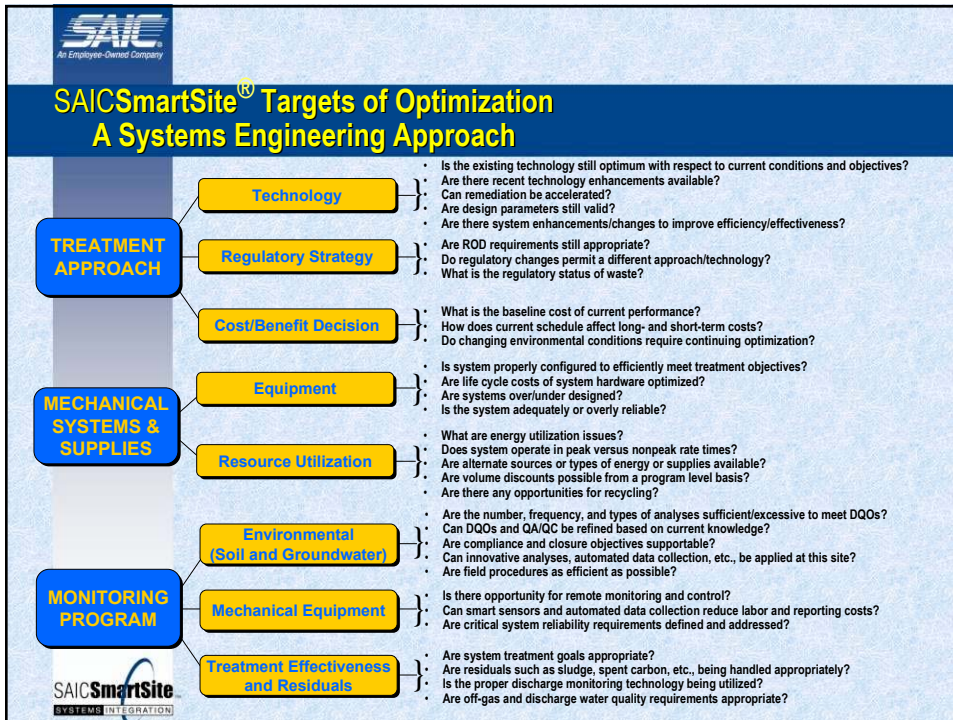
- **Formal, Documented Approach:**
  - ✓ Structured program review process
  - ✓ SmartSite® Optimization Manual
  - ✓ Data collection modules
  - ✓ Formal QA/QC program
  - ✓ Standardized reporting
- **Performance-Based Metrics:**
  - ✓ Mass removal efficiency
  - ✓ Program direct and indirect costs
  - ✓ Regulatory/QA/QC compliance
  - ✓ Environmental/Human exposures

*Industry's only formal documented systems engineering approach to optimization*


**Loring Air Force Base** - Optimization results and recommendations used in CERCLA five-year review documents.

**SITE Program** - Achieving *performance-based metrics* including >95 % mass removal efficiency and assuring no off-site impacts was critical to optimizing this *innovative co-metabolic bioremediation* program.


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|  |                                                                                                                                                                                                         |                                                                                                                                                                                                                                      |                           |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| SmartSite® Optimization Opportunity Examples                                      |                                                                                                                                                                                                         |                                                                                                                                                                                                                                      |                           |
| Project                                                                           | Optimization Opportunity                                                                                                                                                                                | Developed Alternative                                                                                                                                                                                                                | Annual Savings            |
| <b>Environmental Systems Components</b>                                           |                                                                                                                                                                                                         |                                                                                                                                                                                                                                      |                           |
| Wilco Petroleum                                                                   | Recovery of floating product beneath refinery limited by site access constraints and aquifer conditions                                                                                                 | Develop and install single caisson/angle well recovery systems to replace multiple vertical wells                                                                                                                                    | \$350K                    |
| Mound DOE                                                                         | Low soil oxygen concentrations due to soil saturation, and low soil nitrogen concentrations are limiting biodegradation rates which extends required remediation time associated with landfill leachate | Use existing dewatering trenches to decrease saturation. Install dual soil vacuum extraction/air injections system beneath landfill using angle drilling technique to enhance biodegradation rates coupled with mass removal by SVE. | \$60K                     |
| CBS                                                                               | Solution weathering and geologic conditions limit capture and mass removal rates of P&T system                                                                                                          | Installation of angle drilled wells at strategic locations to intercept conduits of contaminant flow which eliminates the need for 2 wells                                                                                           | \$45K                     |
| Olivetti Supplies                                                                 | Decline in groundwater concentrations and characterization of surface water receptors altered remedial requirements                                                                                     | Perform fate and transport analysis along with human health and environmental risk assessment. Gain regulatory approval for NFA based on risk assessment results.                                                                    | N/A-- Accelerated Closure |
| <b>Site Operating System Components</b>                                           |                                                                                                                                                                                                         |                                                                                                                                                                                                                                      |                           |
| Aberdeen Proving Ground                                                           | Iron fouling of groundwater extraction system<br>High pump repair and maintenance costs<br>Clogging and intensive maintenance of well discharge lines                                                   | Replace down-hole Clean Environment pumps with surface mounted double diaphragm pumps<br>Replace bubbler level controls with electrical transducers                                                                                  | \$31K                     |
| Olivetti Supplies, Inc., Harrisburg, PA                                           | Multiple contamination areas require multiple treatment systems                                                                                                                                         | Upsize treatment system to handle most significant area<br>Manifold multiple areas to single treatment system<br>Develop sequential treatment approach for multiple areas using a single treatment system                            | \$42K                     |
| Loring Air Force Base                                                             | Emulsification of recovered product prevents separation by oil water separator.                                                                                                                         | Install second tank in sump.<br>Install positive displacement pump at grade level.<br>Upsize the oil water separator.                                                                                                                | \$24K                     |
| SouthDiv NIROP                                                                    | Piping configuration requires additional pump, resulting in unnecessary electrical power costs                                                                                                          | Reroute and resize piping to provide for gravity discharge                                                                                                                                                                           | \$16K                     |

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|  |                                                                                                                                            |                                                                                                                                                                                                                         |                |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| SmartSite® Optimization Opportunity Examples (cont'd)                               |                                                                                                                                            |                                                                                                                                                                                                                         |                |
| Project                                                                             | Optimization Opportunity                                                                                                                   | Developed Alternative                                                                                                                                                                                                   | Annual Savings |
| <b>Equipment Operations, Maintenance, and Monitoring Component</b>                  |                                                                                                                                            |                                                                                                                                                                                                                         |                |
| Kodak Corporation                                                                   | Management/off-site disposal of acid wash water is labor-intensive and high cost                                                           | Treat water on-site and manage with treated effluent.                                                                                                                                                                   | \$21K          |
| Harley Davidson                                                                     | On-site operational problems associated with complex treatment train required frequent site visits by off-site personnel                   | Configure treatment system SCADA to facilitate off-site problem analysis and resolution by on-site O&M staff                                                                                                            | \$24K          |
| S. Jersey Clothing Site                                                             | System shut down requires on-site acknowledgment of system faults, and manual startup involving over 40 individual system control switches | Configure SCADA for off-site alarm recognition and acknowledgement, and automated sequence up of multiple system controls as one action                                                                                 | \$23K          |
| Higgins Farm                                                                        | Improper set point programming of pH sensors and feed control caused high fluctuations in effluent pH, resulting in frequent system alarms | Reprogram set points and sensor delay functions<br>Reprogram SCADA to allow for off-site alarm recognition                                                                                                              | \$23K          |
| <b>Management and Administrative Function's Component</b>                           |                                                                                                                                            |                                                                                                                                                                                                                         |                |
| Aberdeen Proving Ground                                                             | Manual collection of data is labor intensive and increases monitoring costs.                                                               | Upgrade existing human-machine-interface (HMI) and RF communications linkage.<br>Install PLC panel modifications and instrumentation.<br>Configure system for automated data collection into Microsoft Access database. | \$11K          |
| Northampton Co. Water Authority                                                     | Management of fourteen separate remote pumping centers made performance tracking, monitoring, and management extremely labor intensive     | Developed remote SCADA linkage with each facility, coupled with automated linkage to centralized database to facilitate data management and generation of streamlined reports.                                          | \$40K          |
| Harley Davidson, York, PA                                                           | Multiple remediation programs at single site resulted in intensive data management and reporting                                           | Develop GIS system for management of spatial and numeric information<br>Develop automated data input and standardized reporting functions.                                                                              | \$18K          |


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## Formal and Documented Approach


- LTO/LTM and SmartSite® Manual
- Data Modules
- Dedicated Data Bases
- Structured Review Process
- Documented QA/QC Program
- Formal and Documented LTO/LTM SOPs






## Optimization Approach

|                                                                                           |  |                     |
|-------------------------------------------------------------------------------------------|--|---------------------|
| Background                                                                                |  |                     |
| Chapter 1: Project Initiation/Background Information Review                               |  | 1                   |
| 1.1 Project Approach                                                                      |  | 1                   |
| 1.2 Project Team                                                                          |  | 1                   |
| 1.3 Overview of the Checklist Modules                                                     |  | 2                   |
| 1.4 Project Initiation/Background Information Review                                      |  | 2                   |
| Chapter 2: Site Evaluation                                                                |  | 10                  |
| 2.1 In Brief                                                                              |  | 10                  |
| 2.2 Initial Facility Tour                                                                 |  | 11                  |
| 2.3 Detailed Review of Facility Records                                                   |  | 11                  |
| 2.4 In-Depth Interviews with Site Managers and Facility Operations                        |  | 11                  |
| 2.5 Detailed System(s) Inspections                                                        |  | 12                  |
| 2.6 Initial Data Evaluation                                                               |  | 13                  |
| 2.7 Exit Debrief                                                                          |  | 13                  |
| Chapter 3: Evaluation of Cost Reduction Alternatives                                      |  | 14                  |
| 3.1 Objectives and Approach                                                               |  | 14                  |
| 3.2 Performance Evaluation                                                                |  | 16                  |
| 3.3 Cost Evaluation                                                                       |  | 19                  |
| Chapter 4: Final Report                                                                   |  | 23                  |
| List of Exhibits                                                                          |  |                     |
| Exhibit 1-1 SmartSite Opportunity Assessment                                              |  | Following Chapter 1 |
| Exhibit 1-2 LTO/LTM Opportunity Project Team                                              |  | Following Chapter 1 |
| Exhibit 1-3 Overview of the 14 SmartSite Modules                                          |  | Following Chapter 1 |
| Exhibit 1-4 Data Request Form                                                             |  | Following Chapter 1 |
| Exhibit 1-5 Example of Analyses to be Performed on Initial Data                           |  | Following Chapter 1 |
| Exhibit 3-1 Cost Reduction Alternatives Development Evaluation Process                    |  | Following Chapter 3 |
| Exhibit 3-2 Interrelationship of Alternative Measures Requires to Achieve Cost Reductions |  | Following Chapter 3 |
| List of Appendices                                                                        |  |                     |
| Appendix A Personnel Qualifications                                                       |  | Following Text      |
| Appendix B SmartSite Opportunity Assessment                                               |  | Following Text      |
| Appendix C Guidelines for Optimization Alternatives                                       |  | Following Text      |
| Appendix D Guidelines for Automation Alternatives                                         |  | Following Text      |
| Appendix E Guidelines for Substitution Alternatives                                       |  | Following Text      |
| Appendix F Guidelines for Consolidation Alternatives                                      |  | Following Text      |
| Reference                                                                                 |  | Following Text      |





SAIC's optimization approach is thorough and well documented



## Optimization Approach (cont'd)


- Team approach
- Standardized data collection modules
- Identification of cost-saving opportunities
- Rigorous financial analyses
- Phased implementation

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## SmartSite® Optimization Team



- O&M Field Technician
- Remediation Scientist
- Process Engineer
- Automation and SCADA Engineer
- Information Management Integrator
- Cost Estimator

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## Phased Approach - Minimize Costs/Maximize Return

- STEP 1: Conduct Needs Assessment to Baseline Current Program
  - Reality Check - Redefine program strategies and objectives
  - Review existing program information
  - Perform site visit
  - Evaluate engineering systems, procedures, organization, information management/reporting, compliance issues, cost drivers...
  - Identify opportunities for improvement
  - Evaluate optimization alternatives
  - Perform cost/benefit analysis
  - Develop optimization recommendations
- STEP 2: Develop Long-Term Optimization and Management Plan
- STEP 3: Begin Implementation of Highest Ranked Alternatives
- STEP 4: Evaluate Results Against Performance Metrics
- STEP 5: Adjust Program and Implement Additional Alternatives



## Standardized Data Collection Modules

- Background Information
- System Summary
- Labor
- Maintenance and Repair Management
- Transfer Equipment (pumps, blowers, etc.)
- Instrumentation (inputs)
- Control System
- Controlling Devices (outputs)
- SCADA and Operator Interface
- Management Systems
- Detailed Cost Data
- Monitoring
- Well and Trench Systems
- Specific Problems/Desired Improvements





## Example Data Collection Module

| Module 1—BACKGROUND INFORMATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 | Page _1_ of _2_                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Facility / Site Name: Vineland Chemical Co. Superfund Site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                 |                                                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 | Inspector: R. Cronic                                                                     |
| <b>A. Facility</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                 |                                                                                          |
| Vineland Chemical Co. Superfund Site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                 | 1405 N. Mill Rd.<br>Vineland, NJ 08360<br>Cumberland Co.                                 |
| <b>B. Location</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                 |                                                                                          |
| <b>C. Key Contacts:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                 |                                                                                          |
| Name and Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Address                                                                                                         | Contact Information                                                                      |
| Dave Herwig<br>Program Manager                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vineland Chemical<br>1405 N. Mill Rd.<br>Vineland, NJ 08360                                                     | Phone: 856-690-1758<br>Fax: 856-690-1759<br>E-Mail: daberwig@voicenet.com                |
| Steve Gillespie<br>Site Manager                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Vineland Chemical<br>1405 N. Mill Rd.<br>Vineland, NJ 08360                                                     | Phone: 856-690-1758<br>Fax: 856-690-1759<br>E-Mail: vineland@voicenet.com                |
| Chuck Van Winkle -<br>Plant Superintendent/Head Operator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Vineland Chemical<br>1405 N. Mill Rd.<br>Vineland, NJ 08360                                                     | Phone: 856-690-1758<br>Fax: 856-690-1759<br>E-Mail:                                      |
| Bill Stappferne<br>Maintenance Supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Vineland Chemical<br>1405 N. Mill Rd.<br>Vineland, NJ 08360                                                     | Phone:<br>Fax:<br>E-Mail:                                                                |
| Matthew Westgate<br>Geologist/Project Manager                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | U.S. EPA, Region II<br>Emergency/Remedial Response Div.<br>290 Broadway - 19th Floor<br>New York, NY 10007-1866 | Phone: (212) 637-4422<br>Fax: (212) 637-4422<br>E-Mail: westgate.matthew@epamail.epa.gov |
| Martin Connolly, Project Engineer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | USACE Philadelphia District<br>Vineland Project Office<br>1509 North Mill Rd.<br>Vineland, NJ 08360             | Phone: (856) 794-0925<br>Fax: (856) 794-9828<br>E-Mail: Martin.J.Connolly@nap02.us       |
| <b>D. General Notes (Facility mission, history, risk issues, land use, political issues, etc.):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                 |                                                                                          |
| Site soil and groundwater impacted by arsenic related to historical production of organic arconical herbicides and fungicides since 1949. No. 42 on NPL list. RI/FS completed in 1988. Contaminants of concern are primarily organic (mono and di-methyl arsenic) and inorganic arsenic. Approximately 1 M gpd of groundwater is captured by 13 groundwater extraction wells. Treatment consists of chemical treatment by oxidation, coagulation, sedimentation, filtration, and precipitation. Treated water is discharged to Blackwater Branch under a NPDES permit. |                                                                                                                 |                                                                                          |

## Example Life Cycle Cost Analysis Backup Table

| Col #    | Current Labor Costs |      |                                                                                                                                                              | Rate (\$/hr) | total hours | Unit Cost | Units per year | Annual Cost  |
|----------|---------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------|-----------|----------------|--------------|
|          | Category            | Crew | Description of Work                                                                                                                                          |              |             |           |                |              |
| 1        | Operations          | 1    | Pumping of well vaults - 2 persons, 1 day per week                                                                                                           | 35.00        | 16          | \$ 560.00 | 52             | \$ 28,120.00 |
|          | Operations          | 1    | Note: Cost savings related to more efficient repair of flow meters are accounted for in Section 3.11, and savings due to reduced cleaning of discharge lines | 35.00        |             | \$ -      |                | \$ -         |
|          | Monitoring          |      |                                                                                                                                                              | 35.00        |             | \$ -      |                | \$ -         |
|          | Admin.              |      | are included in section 3.4                                                                                                                                  | 65.00        |             | \$ -      |                | \$ -         |
|          | Engineering         |      |                                                                                                                                                              | 65.00        |             | \$ -      |                | \$ -         |
| SubTotal |                     |      |                                                                                                                                                              |              | 16.0        | \$ 560.00 |                | \$ 29,120.00 |

| Col #    | Current Cost of Operations - Equipment and Subcontracts |  |                                              | Unit Cost | Units per year | Annual Cost |
|----------|---------------------------------------------------------|--|----------------------------------------------|-----------|----------------|-------------|
|          | Category                                                |  |                                              |           |                |             |
| 1        | Analytical                                              |  |                                              |           |                | \$ -        |
|          | Subcontracts                                            |  | Sludge disposal - 3 bbls X 52 wks X \$ 14/lb | \$ 22.00  | 1              | \$ 22.00    |
|          | Utilities                                               |  |                                              |           |                | \$ -        |
|          | Chemicals                                               |  |                                              |           |                | \$ -        |
|          | Equipment                                               |  |                                              |           |                | \$ -        |
|          | Materials                                               |  |                                              |           |                | \$ -        |
|          | Supplies                                                |  | Misc - Sump pump, truck, etc.                | \$ 10.00  | 52             | \$ 520.00   |
| SubTotal |                                                         |  |                                              | \$ 32.00  |                | \$ 542.00   |

| Col #    | Proposed Operations Labor Costs |      |                                                              | Rate (\$/hr) | total hours | Unit Cost | Units per year | Annual Cost |
|----------|---------------------------------|------|--------------------------------------------------------------|--------------|-------------|-----------|----------------|-------------|
|          | Category                        | Crew | Description of Work                                          |              |             |           |                |             |
| 3        | Operations                      | 1    | Periodic pumping of well vaults - 2 persons, 1 day per month | 35.00        | 16          | \$ 560.00 | 12             | \$ 6,720.00 |
|          | Maintenance                     |      |                                                              | 35.00        |             | \$ -      |                | \$ -        |
|          | Monitoring                      |      |                                                              | 35.00        |             | \$ -      |                | \$ -        |
|          | Admin.                          |      |                                                              | 65.00        |             | \$ -      |                | \$ -        |
|          | Engineering                     |      |                                                              | 65.00        |             | \$ -      |                | \$ -        |
| SubTotal |                                 |      |                                                              |              | 16.0        | \$ 560.00 |                | \$ 6,720.00 |


## Example Life Cycle Costing Analysis Summary Table

|                                                                                                                                  |                                          |                                                                                                                                   |                                           |                                      |                           |                               |                         |                              |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------|---------------------------|-------------------------------|-------------------------|------------------------------|
| Life of the facility in years =                                                                                                  |                                          | 30                                                                                                                                |                                           | Date Prepared:                       |                           | 02-Aug-01                     |                         |                              |
| Discount Factor in percent =                                                                                                     |                                          | 6%                                                                                                                                |                                           | Prepared by:                         |                           | R. Cronic                     |                         |                              |
| Project:                                                                                                                         |                                          | Vineland Chemical                                                                                                                 |                                           |                                      |                           |                               |                         |                              |
| Alternative Name:                                                                                                                |                                          | Evaluation of Well Vault Monitoring and Maintenance                                                                               |                                           |                                      |                           |                               |                         |                              |
| Description of Alternative:                                                                                                      |                                          | Site grading for surface water control.<br>Sealing of interior vault seams.<br>Replacement of concrete covers with lighter doors. |                                           |                                      |                           |                               |                         |                              |
|                                                                                                                                  | Column 1                                 | Column 2                                                                                                                          | Column 3                                  | Column 4                             | Column 5                  | Column 6                      | Column 7                | Column 8                     |
| Cost Category                                                                                                                    | Est. Cost of Current Operations (Annual) | PW of Current Operations                                                                                                          | Est. Cost of Proposed Operations (Annual) | Capital Cost of Proposed Alternative | PW of Proposed Operations | Annual Operating Cost Savings | Potential R O I (Years) | Potential Life Cycle Savings |
|                                                                                                                                  | Note 1                                   | Note 2                                                                                                                            |                                           |                                      | Note 3                    | (Col. 1 - Col. 3)             | (Col.4 / Col.1)         | (Col. 2 - Col. 5)            |
| Labor                                                                                                                            |                                          |                                                                                                                                   |                                           |                                      |                           |                               |                         |                              |
| Operations                                                                                                                       | \$ 29,120.00                             | \$ 400,831.88                                                                                                                     | \$ 6,720.00                               | \$ 11,200.00                         | \$ 103,699.67             | \$ 22,400.00                  |                         | \$ 297,132.22                |
| Maintenance                                                                                                                      | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ -                                 | \$ -                      | \$ -                          |                         | \$ -                         |
| Monitoring                                                                                                                       | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ -                                 | \$ -                      | \$ -                          |                         | \$ -                         |
| Administration                                                                                                                   | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ -                                 | \$ -                      | \$ -                          |                         | \$ -                         |
| Engineering                                                                                                                      | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ 520.00                            | \$ 520.00                 | \$ -                          |                         | \$ (520.00)                  |
| Analytical                                                                                                                       | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ -                                 | \$ -                      | \$ -                          |                         | \$ -                         |
| Subcontract                                                                                                                      | \$ 22.00                                 | \$ 302.83                                                                                                                         | \$ -                                      | \$ -                                 | \$ -                      | \$ 22.00                      |                         | \$ 302.83                    |
| Utility                                                                                                                          | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ -                                 | \$ -                      | \$ -                          |                         | \$ -                         |
| Chemicals                                                                                                                        | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ -                                 | \$ -                      | \$ -                          |                         | \$ -                         |
| Equipment                                                                                                                        | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ -                                 | \$ -                      | \$ -                          |                         | \$ -                         |
| Materials                                                                                                                        | \$ -                                     | \$ -                                                                                                                              | \$ -                                      | \$ 20,000.00                         | \$ 20,000.00              | \$ -                          |                         | \$ (20,000.00)               |
| Supplies                                                                                                                         | \$ 520.00                                | \$ 7,157.71                                                                                                                       | \$ 120.00                                 | \$ 500.00                            | \$ 2,151.78               | \$ 400.00                     |                         | \$ 5,005.93                  |
|                                                                                                                                  |                                          | \$ -                                                                                                                              |                                           |                                      | \$ -                      | \$ -                          |                         | \$ -                         |
| Totals                                                                                                                           | \$ 29,662.00                             | \$ 408,292.42                                                                                                                     | \$ 6,840.00                               | \$ 32,220.00                         | \$ 126,371.45             | \$ 22,822.00                  | 1.41                    | \$ 281,920.98                |
| Note 1: Based on present estimated annual costs impacted by this alternative only.                                               |                                          |                                                                                                                                   |                                           |                                      |                           |                               |                         |                              |
| Note 2: The present worth of annual costs are based on a facility life and discount factor listed above. PW Factor = 13.76483115 |                                          |                                                                                                                                   |                                           |                                      |                           |                               |                         |                              |

## Example Summary of Alternatives Cost Analysis

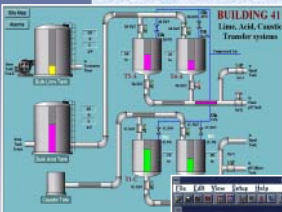
| Program Element                                                  | Alternative Evaluated                                                                                                    | Initial Cost       | Annual Cost Savings | Life-Cycle Savings <sup>1</sup> | Return on Investment (years) |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|---------------------------------|------------------------------|
| Well Field Management for Flow Maximization                      | Redevelop 14 RW's, reconstruct RW-9, and hydrogeologic testing of two RW's                                               | \$173,000          | N/A                 | \$1,765,950                     | N/A                          |
| Fouling of Groundwater Extraction Pumps                          | Addition of automated sequestering agent system.                                                                         | \$36,000           | (\$43,538)          | (\$635,293)                     | (0.8)                        |
| Performance of Groundwater Influent Lines                        | New transfer main                                                                                                        | \$288,360          | \$19,360            | \$69,000                        | 15                           |
| Well Vault Monitoring and Maintenance                            | Replace covers, seal vaults, and grade area.                                                                             | \$32,200           | \$22,822            | \$281,920                       | 1.4                          |
| Hydraulic Capacity of the Treatment Plant                        | Add level control for coagulation tanks                                                                                  | \$7,040            | \$550               | \$500                           | 12.9                         |
| Performance Enhancement Through Flow Equalization                | Addition of equalization tank system                                                                                     | \$156,500          | \$51,300            | \$549,635                       | 3.0                          |
| Chemical Usage Rates                                             | Optimization of current protocols, eliminate second organic train, chemical elimination, and addition of polishing unit. | \$296,093          | \$337,068           | \$4,343,585                     | 0.9                          |
| Performance of DAF Units                                         | Modify discharge pipe weir and add internal sludge collection pipes.                                                     | \$25,660           | \$24,500            | \$311,647                       | 1                            |
| Performance of Chemical and Polymer Feed Pumps                   | Replace existing pumps and add two new chemical dilution stations.                                                       | \$25,000           | \$4,300             | \$34,200                        | 5.8                          |
| Performance of Flow Meters                                       | Replace well flow meters with magnetic                                                                                   | \$27,300           | \$10,920            | \$123,012                       | 2.5                          |
| Compressed Air System                                            | Add third compressor.                                                                                                    | \$15,600           | \$1,875             | \$10,195                        | 8.3                          |
| Sludge Dewatering and Management                                 | Replace centrifuges with filter presses                                                                                  | \$280,500          | \$96,300            | \$1,045,400                     | 2.9                          |
| Installation of MOVs in Chemical Storage Facility                | Install motor operators on valves                                                                                        | \$64,175           | \$315               | \$0                             | >30                          |
| SCADA System – Well Field Control and Operations Monitoring      | Implement SCADA well field control and monitoring                                                                        | \$45,660           | \$6,370             | \$42,022                        | 7.2                          |
| SCADA System – Treatment Plant Control and Operations Monitoring | Implement integrated plant control and monitoring                                                                        | \$104,200          | \$28,600            | \$289,474                       | 3.6                          |
| SCADA System – Operator SCADA Control of Chemical Feed Rates     | Integrate chemical feed rate control into PLC                                                                            | \$50,000           | \$25,662            | \$303,233                       | 2.0                          |
| PLC and VFD Maintenance and Obsolescence                         | Perform VFD survey and substitution design                                                                               | \$6,200            | \$0                 | \$0                             | N/A                          |
| Environmental Monitoring – Well Field Monitoring                 | Optimize sampling frequency and install dedicated sampling pumps                                                         | \$124,500          | \$63,440            | \$748,741                       | 2.0                          |
| Environmental Monitoring – Treatment Plant Monitoring            | Reduce frequency of two off-site sampling parameters                                                                     | \$19,500           | \$11,720            | \$141,824                       | 1.7                          |
| Data Management and Reporting                                    | No opportunities for improvement identified                                                                              | N/A                | N/A                 | N/A                             | N/A                          |
| <b>TOTAL</b>                                                     |                                                                                                                          | <b>\$1,296,873</b> | <b>\$657,778</b>    | <b>\$9,696,354</b>              | <b>1.05</b>                  |





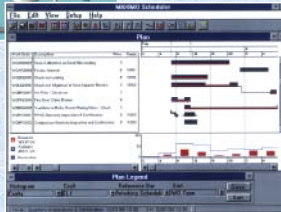
An Employee-Owned Company

# Representative Automation and Information Management Tools



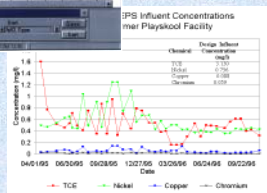
**SCADA**

- Process Automation
- Remote Control
- Alarming
- System Monitoring




**CMMS**

- Work Scheduling
- Maintenance Management
- Materials Purchasing
- Other Resource Management

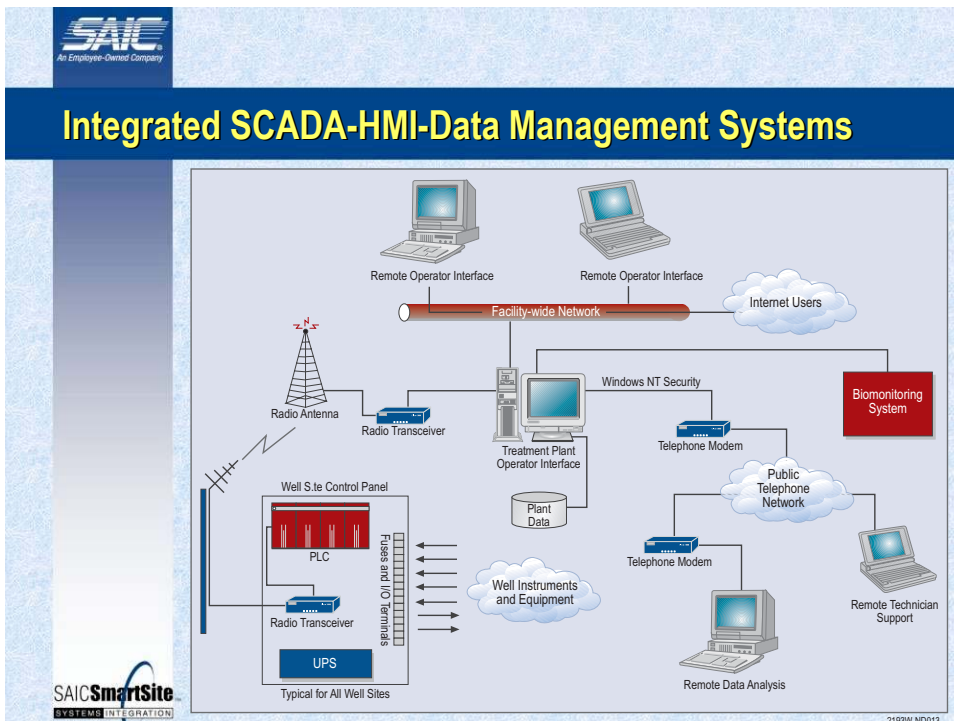


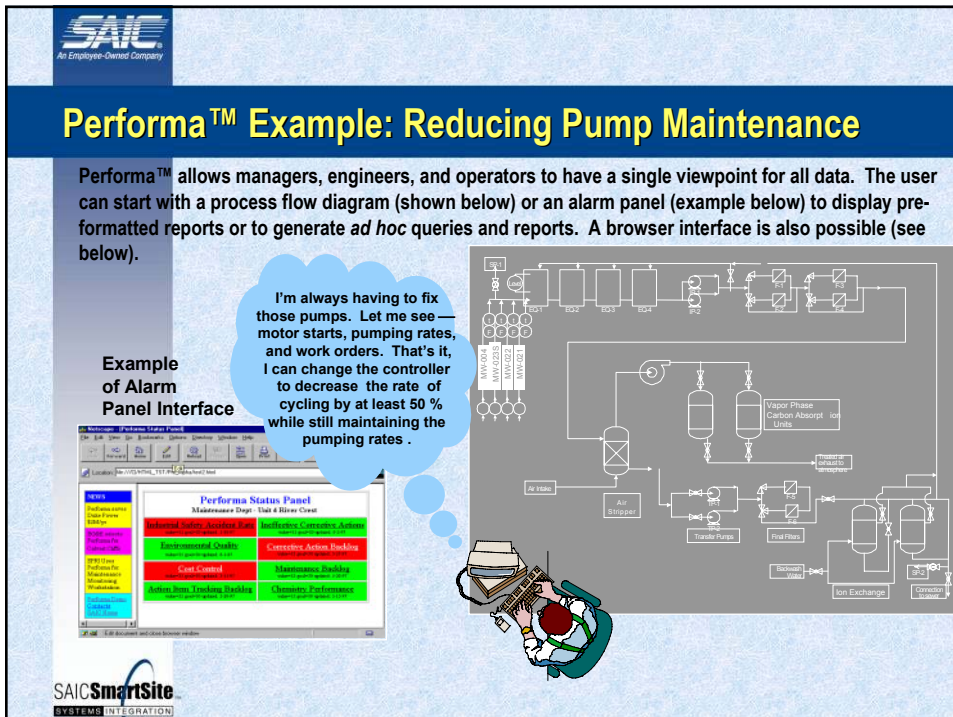
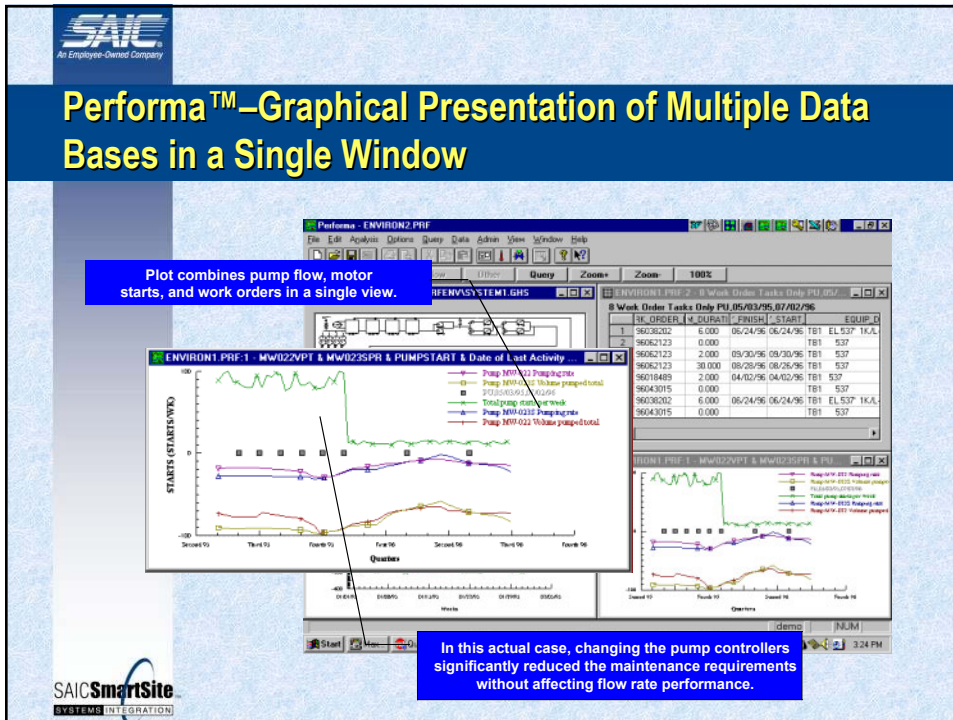
**EHS Data Management**

- Site Information
- Chemical Data Base
- Waste Management
- Tracking and Reporting

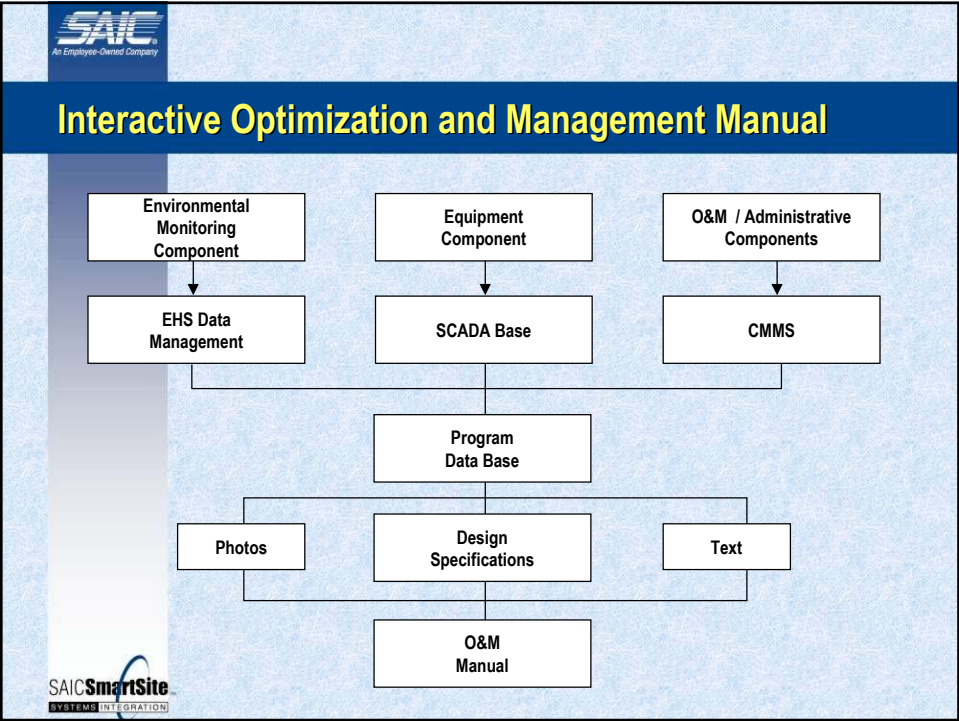
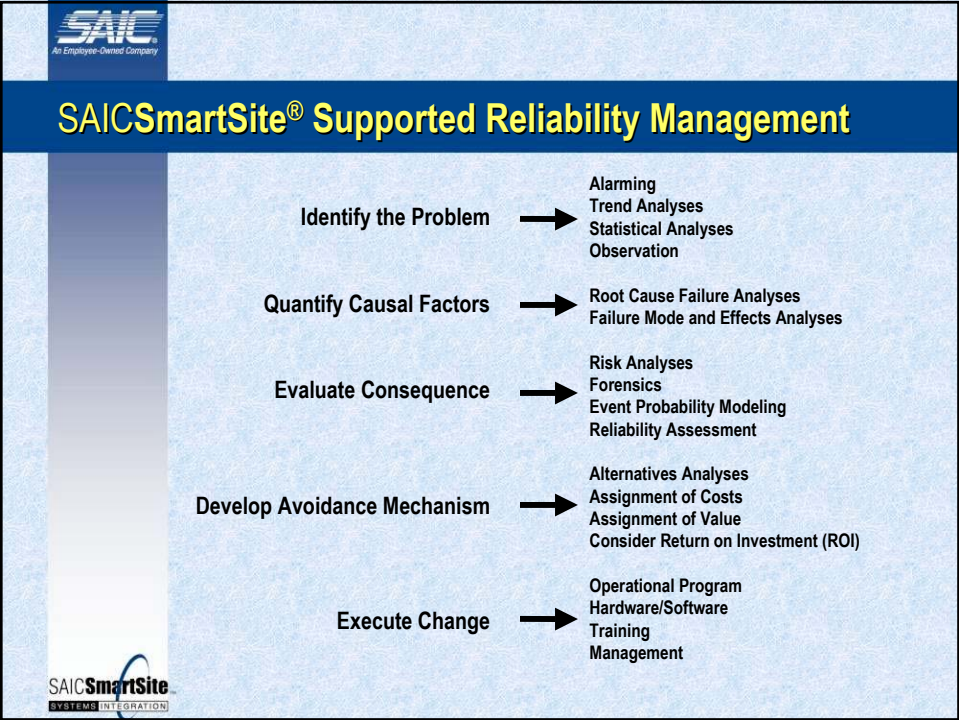


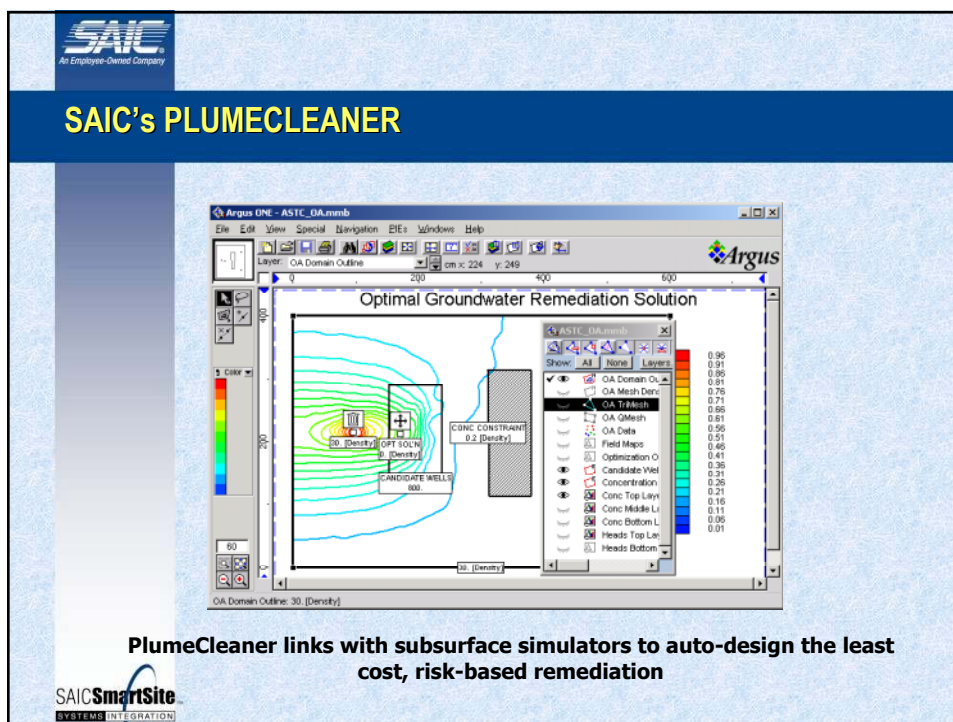
SYSTEMS INTEGRATION











**Summary**

- RAO/LTM Optimization Requirements Are Highly Variable and Technology and Site-Specific
- Systematic and Comprehensive Approach Fully Documents Baseline Conditions
- Multidisciplinary Team Provides Quality Evaluation
- Wide Range in Opportunities for Cost-Saving
- A Systems Analyses of Interdependent Problems and Solutions Yields Optimum Cost Savings
- A Systems Engineering Approach Maximizes Total, Long-Term Cost Savings
- Savings Generally Exceed 20%

SAIC SmartSite  
SYSTEMS INTEGRATION